

REMARKS

Entry of Amendment and IDS

Since a RCE is being filed herewith, this amendment and the IDS of December 7, 2006 should be entered and considered at this time.

Applicants are amending independent Claims 1-9 herein to delete the limitations that the first and second leveling films contain a siloxane structure from these claims. Applicants do not believe that these limitations are necessary for the patentability of the claims and therefore, are now including these features in new dependent Claims 197-205 (see *infra*).

Claim Rejections - 35 USC §103

In the Final Rejection, the Examiner continues to reject Claims 1-10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 31, 33, 35-41, 43-50, 52-59, 61-68, 70-77, 79-86, 88-91, 93-95, 97-101, 103-105, 107-111, 113-115, 117-121, 123-125, 127, 129-131, 133-135, 137, 139-141, 143-145, 147, 149-152 154-156, 158, 161-164, 166-168, 170, 173-176, 178-180 ,182, 185-196 under 35 USC §103(a) as being unpatentable over “applicant’s admitted prior art” in combination with Chen (U.S. 5,453,406), Tang et al. (US 5,550,066) and Hanihara et al. (US 5,990,988). This rejection is respectfully traversed.

More specifically, independent Claims 1-10, 31, 33, 149, 161 and 173 specifically recite first and second leveling films and that the second leveling film is thicker than the first leveling film. As explained in the present application, this feature is highly advantageous for leveling the surface over a wiring. See e.g. pages 3 – 7 and 17 of the specification and Figs. 5 and 6 explaining the advantages achieved by Applicants through their conception of the method of the present invention wherein the second leveling film is thicker than the first leveling film. For at least the reasons explained in the

specification, this is a non-obvious discovery which is highly advantageous and is not a matter of routine experimentation.

In the Final Rejection, the Examiner admits that “applicant’s admitted prior art” does not show the second leveling layer over the first leveling layer. The Examiner, however, cites Chen as showing a second leveling layer 42 over a first leveling layer 40 and contends that Chen teaches that the thickness of the first leveling film 40 is 2000 to 3000 Angstroms (citing Chen, col. 6, lns. 1-10) and is thinner than the thickness of the second leveling film 42 (which the Examiner contends is 4000 to 6000 Angstroms, citing Chen, col. 6, lns. 53-54). The Examiner then states that both first and second leveling films are formed by spin coating and by the same material, citing Col. 6, ln. 30 in Chen.

As explained below, Applicants respectfully submit that the Examiner’s interpretation of Chen is technically incorrect and one skilled in the art would not interpret Chen in the manner that the Examiner has interpreted Chen.

For example, at col. 6, lns. 25-55, Chen teaches:

Referring next to FIG. 7, a *second spin-on-glass layer 42* is now formed over the first spin-on-glass layer 40 essentially planarizing the dielectric layer and completing the process. This second spin-on-glass *layer 42 is formed* by also using the liquid precursor of the siloxane type *similar in composition to the material used for the first spin-on-glass layer 40, but in this second coating the spin-on-glass is dispensed at a significantly higher spin speed* and at a constant speed. The *same series of spin-on-glass is used for both layers*.

The substrate is again placed on a spin coater and brought to a constant rotational speed in the range of about 2500 to 3000 revolutions per minute (rpm) before dispensing the spin-on-glass and then the substrate is maintained at this constant rotational speed for an additional 6 seconds. The substrate is then brought to a stationary position, that is the spin speed is reduced to zero rpm and the second spin-on-glass layer is allowed to air dry at room temperature of about

25°C for an additional 15 seconds. The substrate is then baked, for example on a hot plate, at a temperature of between about 100° to 300°C for a time of between about 0.5 to 2.0 minutes. The spin-on-glass layer 42 is then pyrolyzed at a relatively high temperature to form an inorganic glass. The preferred curing temperature for this last step is between about 400° to 450°C and for a time of about 20 to 30 minutes, and more specifically at a temperature of 425°C for 30 minutes thereby forming the inorganic glass. *The preferred thickness of layer 42 is between about 4000 to 6000 Angstroms* as can be seen in FIG. 7, the spin-on-glass dielectric layer fills the recesses and essentially planarizes the irregular recesses or gaps on the substrate. (emphasis added)

Hence, from this section, Chen teaches that preferably layer 42 has a thickness between about 4000 to 6000 Angstroms, and that the spin-on-glass used to form layer 42 is dispensed at a significantly higher speed (i.e. 2500 to 3000 rpm) than the speed for dispensing the first layer 40.

At Col. 6, Ins. 10-24, Chen teaches:

Referring now more particularly to the method of coating the substrate to form the planarizing dielectric layer over the patterned conducting layer, a first spin-on-glass *coating 40, is formed* by first bringing the substrate to a constant rotational speed in the range of about 600 to 800 revolutions per minute (rpm) and then dispensing the spin-on-glass liquid precursor for about 6 seconds. The spin-on-glass is then allowed to air dry at room temperature of about 25°C for another 15 second at the above constant rotational speed. The substrate is then removed from the spin coater and baked, for example on a hot plate, at a temperature of between about 100 to 300 for a time of between 0.5 to 2.0 minutes. Because of this lower and constant spin speed the recesses or gaps between the patterned conductor 34 fill more evenly, as was depicted earlier in FIGS. 3A and 3B. (emphasis added)

Hence, from this section, Chen clearly teaches that layer 40 is formed at a rotational speed of about 600 to 800 rpm. This is significantly less than the speed used to form layer 42, as shown above. This section does not recite any specifics as to the actual thickness of layer 40.

One skilled in the art, however, would clearly understand from the two above passages that layer 40 in Chen must be thicker than layer 42. More specifically, if the same materials are used for layers 40 and 42 (which they may be in Chen¹), then it is well known in the art that the thickness of a spin coated film *decreases* as the rotational speed *increases*, i.e. the faster the rotational speed, the thinner the layer. In support thereof, Applicants previously submitted an article, Dietrich Meyerhofer, "Characteristics of resist films produced by spinning," J. Appl. Phys. 49(7), July 1978, p. 3993-3997.² In particular, Figs. 2 and 4 in Meyerhofer clearly demonstrate that the greater the spin speed (in rpms), the thinner the film thickness.

Accordingly, if layers 40 and 42 in Chen are formed of the same materials and since layer 42 is being applied at a spin speed significantly higher than that of layer 40, layer 42 (the alleged second layer) must be thinner than layer 40 (the alleged first layer). If layers 40 and 42 are formed of similar materials (not the same materials), at the very least, Applicants assert that the thickness of layer 40 is not taught or suggested by Chen. One skilled in the art would clearly appreciate these points.

In contrast, independent Claims 1-10, 31, 33, 149, 161 and 173 of the present application specifically recite that the second leveling film is thicker than the first leveling film.

The Examiner, however, cites to col. 5, ln. 61 - col. 6, ln. 24 in Chen which the Examiner contends teaches the formation of the first spin-on-glass layer 40 as having a thickness of 2000-3000 Angstroms and as a result being thinner than layer 42. Applicants respectfully submit that the Examiner's interpretation of this section in Chen is technically incorrect and one skilled in the art would not interpret this passage in the same manner as the Examiner.

¹ It is noted that col. 6, lns. 25-55 in Chen state that layer 42 is formed by using "the liquid precursor of the siloxane type *similar* in composition to the material used for the first spin-on-glass layer 40" and "[t]he *same* series of spin-on-glass is used for both layers" (emphasis added). However, as explained above, whether it is the *same* or *similar* material Chen does not teach the specific thickness of layer 40 and does not disclose or suggest the claimed structure of the present application.

In particular, col. 5, line 62 to col. 6, line 9 in Chen states:

“Now referring to FIG. 6, a first spin-on-glass layer 40 is formed over the insulating layer 36 by spin coating. The preferred material used is a spin-on-glass liquid which consist of a silicon-oxide (Si--O) network polymer dissolved in a common organic solvent, such as alcohol, ketones and esters. And more specifically the preferred spin-on-glass material is a series of siloxane base material marketed by the Allied-Signal Corp. under the trade name ACCUGLASS. The preferred material in the series being ACCUGLASS 211, 314 or 311. The primary difference between the spin-on-glass types is the viscosity (solid content). For example, the series 211 has a lower viscosity and produces a thinner coating of about 2000 Angstroms while series 314 and 311 have a higher viscosity and produce coatings of about 3000 Angstroms.” (emphasis added)

In this section, Chen is merely discussing the primary difference between ACCUGLASS 211, 314 or 311, not the thickness of layer 40. This discussion is consistent with the materials provided by Honeywell regarding the Accuglass 211 and 311.³ As shown in the previously submitted Honeywell literature⁴, Accuglass 211 has a thickness of approximately 2000 Angstroms *at a spin speed of 3000 rpm*, while Accuglass 311 has a thickness of approximately 3000 Angstroms *at a spin speed of 3000 rpm*. Further, the literature shows that *at slower spin speeds*, both Accuglass 211 and Accuglass 311 have a higher thicknesses.

Therefore, at a spin speed of 600 to 800 rpms as taught in Chen, layer 40 of Accuglass 211 or 311 would have a thickness higher than the thickness of layer 42 of Accuglass 211 or 311 at a spin speed of 2500 to 3000 rpms.

Hence, the passage at col. 5, line 62 to col. 6, line 9 in Chen does not support the Examiner’s contention that the actual thickness of layer 40 is between 2000-3000 Angstroms. Instead, this

² A copy of this reference was enclosed with the IDS filed August 16, 2006.

³ As shown in the materials attached to the Response (M) filed on August 16, 2006, the trademark for Accuglass is currently owned by Honeywell. Honeywell received this trademark from AlliedSignal as the result of a merger.

passage merely discusses the differences between these materials, and if the two films are formed at the same speed, except for the difference in starting materials, the film formed from the series 211 is about 2000 Angstroms and the film formed from the series 311 or 314 is about 3000 Angstroms. As explained above, there is no specific disclosure in Chen as to the thickness of layer 40, other than what one skilled in the art could interpret based on the spin speed, and such an interpretation would have to conclude that layer 40 is thicker than layer 42.

As explained above, the Examiner's conclusion that layer 40 is 2000 – 3000 Angstroms is directly in contrast to the teachings in Chen that layer 40 is formed at a slower spin speed than layer 42 and that layer 42 has a thickness between 4000 – 6000 Angstroms.

Therefore, Chen does not disclose or suggest the claimed feature of the present application that said second leveling film is thicker than said first leveling film.

The Examiner also contends that it would be a routine matter of experimentation as to choice of thickness layers. However, as explained above, Chen clearly teaches to those skilled in the art, based on the various rotation speeds, that the first layer 40 is thicker than the second layer 42. There is no disclosure or suggestion in Chen of the reverse configuration. In actuality if one skilled in the art were to follow the various conflicting citations in Chen which the Examiner relies upon, the only possible conclusion is that the disclosure in Chen is simply unreliable and unclear on the actual thickness of the two layers. The teachings in the reference regarding such thicknesses are confusing and contradictory. As a result, one skilled in the art reading this reference cannot confidently arrive at any conclusion as to the actual thicknesses of the two layers. Hence, there is nothing in Chen to suggest the claimed structure of the present application or to suggest that the claimed structure is merely routine experimentation. In fact, by reciting the specific spinning speeds discussed above,

⁴ A copy of this reference was enclosed with the IDS filed on August 16, 2006.

Chen is clearly teaching away from the configuration of the claimed invention.

The Examiner's argument regarding choosing a thickness for the two films and all the possible variables to consider appears to be that it "would be obvious to try" the claimed thicknesses and arrive at the claimed relation between the two layers. Such "obvious to try" standard is improper. See Ecolochem Inc. v. Southern California Edison Co., 227 F.3d 1361, 56 USPQ2d 1065, 1075 (Fed. Cir. 2000); In re Roemer, 258 F.3d 1303, 59 USPQ2d 1527, 1531 (Fed. Cir. 2001).

Further, the Examiner's entire argument appears to be based on hindsight reconstruction. The Examiner has taken the claimed thicknesses of the leveling films and has picked and chosen isolated portions of Chen to allegedly read on the claimed thicknesses. However, it is improper to pick and choose among isolated disclosures to deprecate the claimed invention. In re Fine, 873 F.2d 1071, 1074, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988); Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc., 796 F.2d 443, 230 USPQ 416, 419-420 (Fed. Cir. 1986). To do so is to engage in hindsight reconstruction which is improper. Id.

Instead, the reference must be considered in its entirety. Id. When considered in its entirety, one skilled in the art would conclude that based on the disclosure of spinning speeds that layer 42 (the second leveling layer) is thinner than layer 40 (the first leveling layer) or would have to conclude that Chen is vague and unclear and does not teach the relative thicknesses of the two layers.

As none of the other references disclose this claimed feature, independent Claims 1-10, 31, 33, 149, 161 and 173 and those claims dependent thereon are not disclosed or suggested by the cited references and are patentable thereover. Accordingly, it is respectfully requested that this rejection be withdrawn.

New Claims

Applicants are adding new dependent Claims 197-205. Each of these claims includes the features that were deleted, in this amendment, from independent Claims 1-9 that the first and second leveling films contain a siloxane structure. Hence, no matter is being added.

As these are dependent claims, they are allowable for at least the reasons discussed above for the independent claims. Accordingly, as a RCE is being filed herewith, it is respectfully requested that these new claims be entered and allowed.

If a fee should be due for these new claims, please charge our deposit account 50/1039.

Information Disclosure Statement

Applicants filed an information disclosure statement on December 7, 2006. As a RCE is being filed herewith, it is respectfully requested that this IDS be entered and considered at this time.

Conclusion

It is respectfully submitted that the present application is in a condition for allowance and should be allowed.

If any further fee should be due for this amendment, the RCE, the prior IDS or the extension of time, please charge our deposit account 50/1039.

Favorable reconsideration is earnestly solicited.

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